Feed innovations for improved livestock productivity in the Ethiopian highlands: Africa RISING experiences

Melkamu Bezabih, Kindu Mekonnen, Abera Adie, Peter Thorne

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Outline

- Feed resource challenges
- Africa RISING feeds and forage action research
- Lessons learnt
- Ways forward

Feed resource challenges

- Feed resource base in the highlands on a constant decline
  - Population pressure
  - Shrinking grazing lands
  - Land degradation and loss of soil fertility
- Crop residues - constitute 20 – 80 % of feed resource
  - Implications on crop-livestock productivity, and sustainability of the farming system
- Concerted effort needed to realize planned targets for the livestock sub-sector under GTP II

Africa RISING feeds and forage action research

Approaches:

- Diagnostic and baseline surveys
- Innovation platforms (IPs)
- Research protocols based on the needs of communities
- Framers research groups (FRGs) around each protocol
- Evaluation and approval of research protocols by IPs
- Implementation through FRGs

Research protocols:

I. Integration of fodder and soil fertilizer trees in the farming system

- **Tree Lucerne**: a leguminous fodder tree, well adapted to the highlands of Ethiopia:
  - CP 17 – 21%
  - *In vitro* DM digestibility ca. 70%
  - More than 285 farmers participated in the action research across eight kebeles

Table 1. Mean survival, height and RCD by region after 9 months of growth

Survival and growth	Basona (Amhara)	Sinana (Oromia)	Endamo (Tigray)	Lemo (SNNRS)	P value
Survival (%)	14.8	**35.2**	17.9	**43.6**	0.000
Height (m)	0.36	**1.24**	0.46	**0.66**	0.021
RCD (cm)	0.34	**0.88**	0.56	**0.93**	0.002

***Key determinants of growth and survival**: fencing, watering; mulching; manuring; farm typology

Figure 1. Biomass yield of tree Lucerne under different cutting height and interval

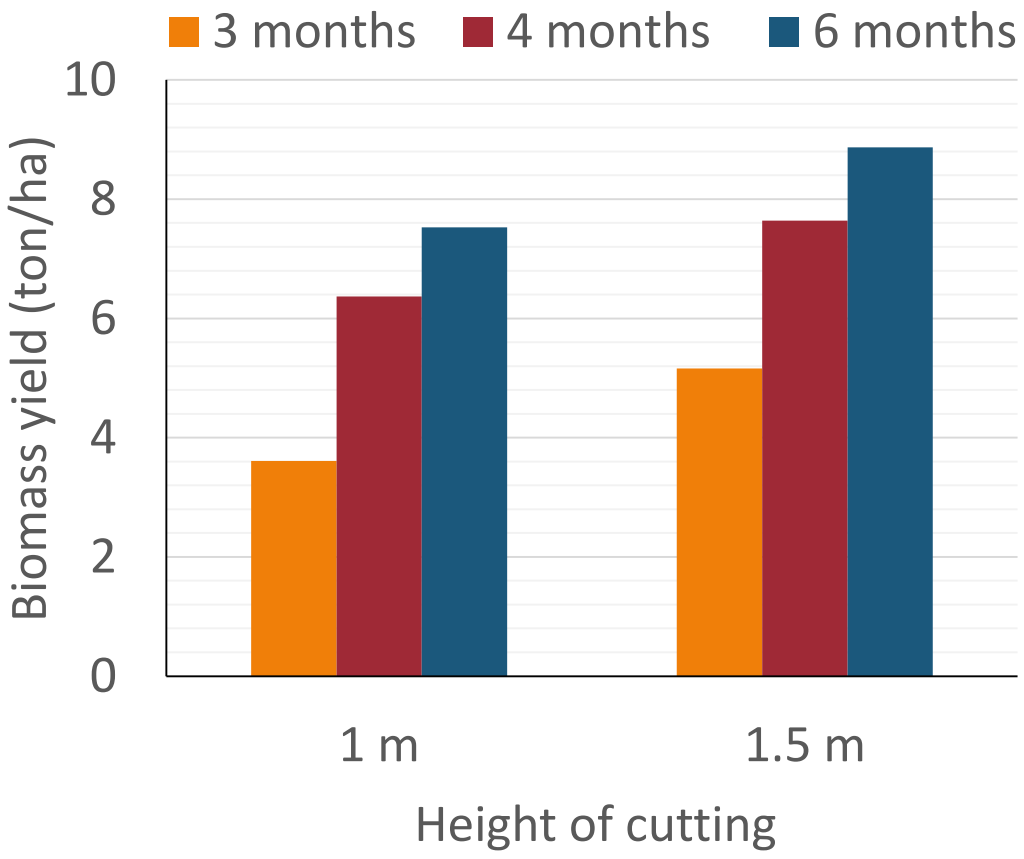


Table 2. Effect of tree Lucerne leaf supplementation on the weight gain of Menz sheep fed barley straw basal diet

Variables	Supplementation levels (g DM/d)				P
	100	200	300	400	
Dry matter intake (g)	477^{d}	559^{c}	**635^{b}**	**717^{a}**	<0.001
DM digestibility (%)	57.6^{c}	60.3^{c}	**66.1^{b}**	**72.1^{a}**	<0.001
Daily weight gain (g)	19.8^{d}	40.3^{b}	**55.7^{ab}**	**72.5^{a}**	<0.001
FCE* (g DWG/g DMI)	0.04^{c}	0.07^{b}	**0.09^{ab}**	**0.10^{a}**	<0.001
Dressing percentage (%)	40.5^{c}	45.0^{b}	**47.0^{ab}**	**48.2^{a}**	<0.001

*FCE = feed conversion efficiency

II. Cultivated forages: annuals and perennials

- Involving more than 600 farmers
- Oat-vetch mixture
- Desho grass
- Sweet lupin as feed and food
- Faba bean forage intercropping



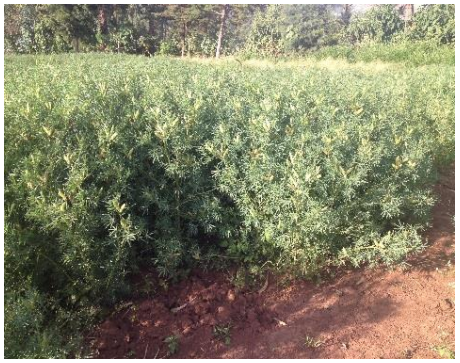
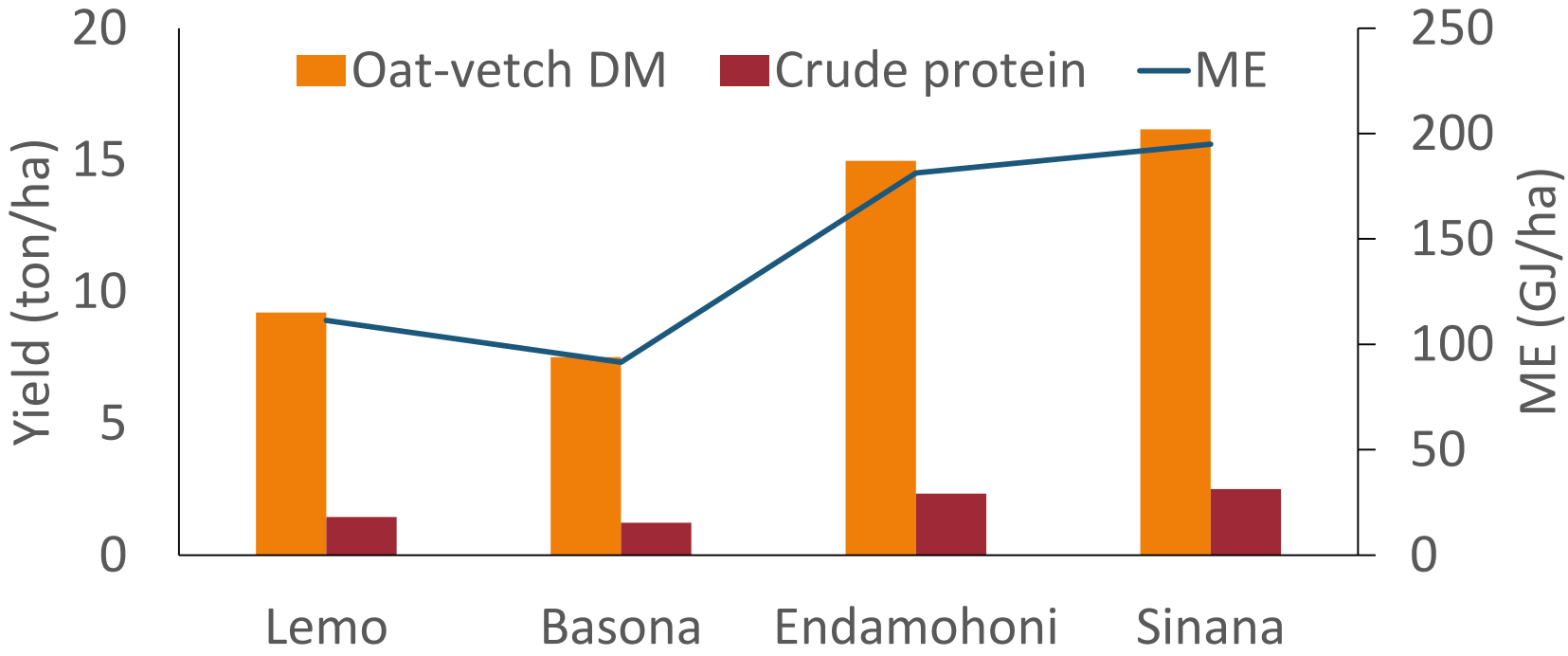



Figure 2. Yield and nutritional quality of oat-vetch mixture in the AR sites

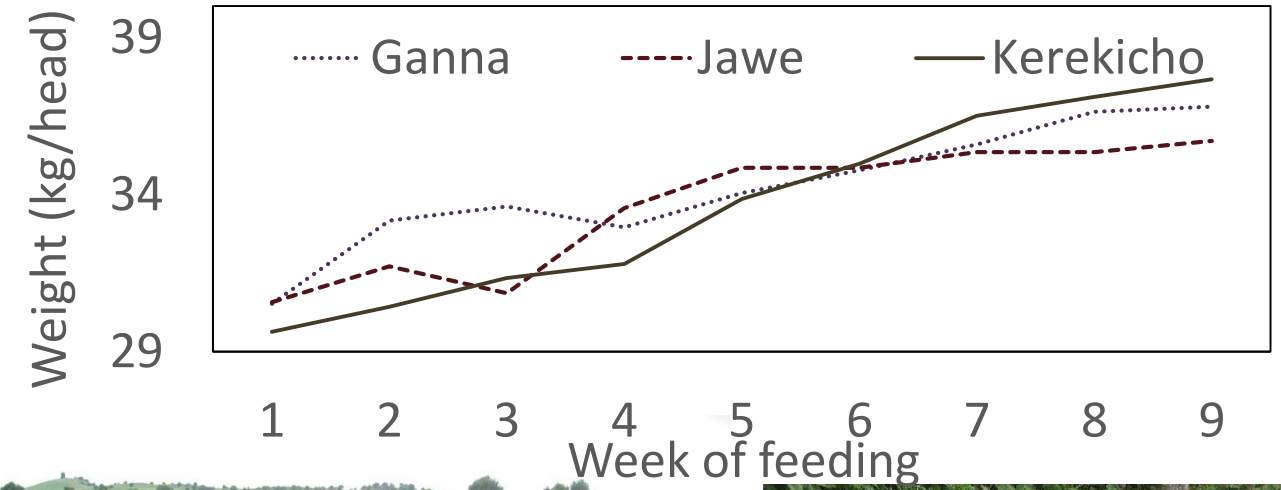


➢ High biomass yield of good nutritional quality from limited plots of land

Table 3. Effect of supplementing about 2.0 kg oat-vetch hay daily on milk yield of lactating cows in Endamohoni

Breed type	Milk yield (Lt/day/cow)	
	Before supplementation	After supplementation
Cross-bred	3.0±1.0	5.33±1.04
Local cow	1.75±0.5	2.75±0.65

Figure 3. Weight gain of Doyogena sheep supplemented daily with 200 g DM of oat-vetch forage in Lemo



Faba bean forage intercropping

- Traditional faba bean production practice – weeds used as *ad hoc* forage intercrops
- 'Improved' practice – weeded frequently
- Trade offs and benefits - traditional versus improved practices
  - Loss in grain yield but gain in feed biomass

Figure 4. yield components of faba bean plots

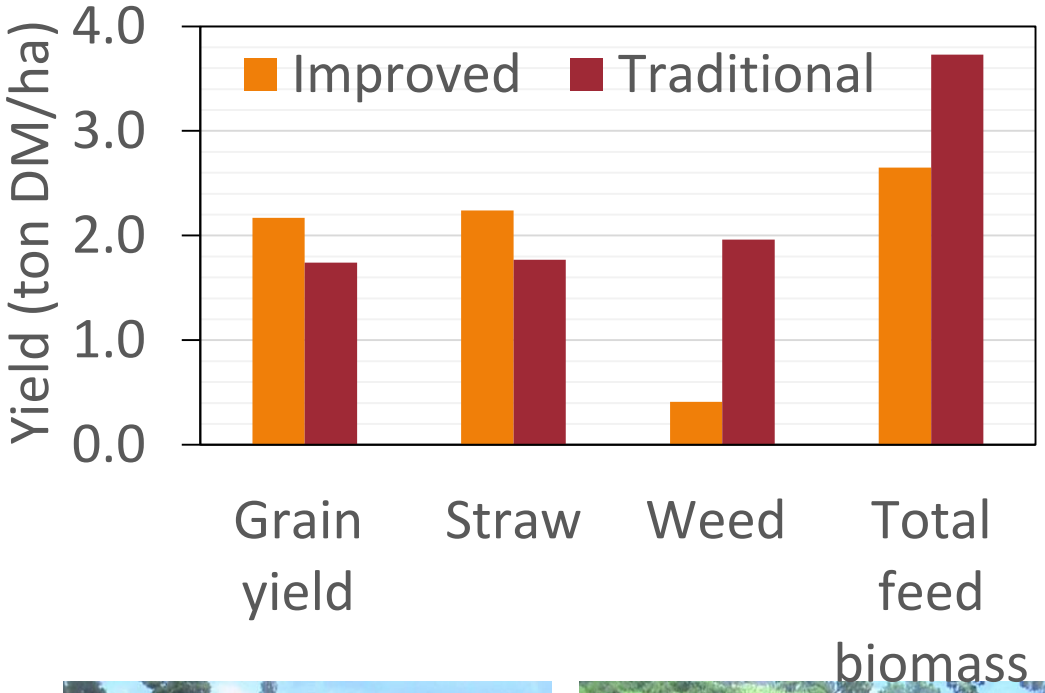
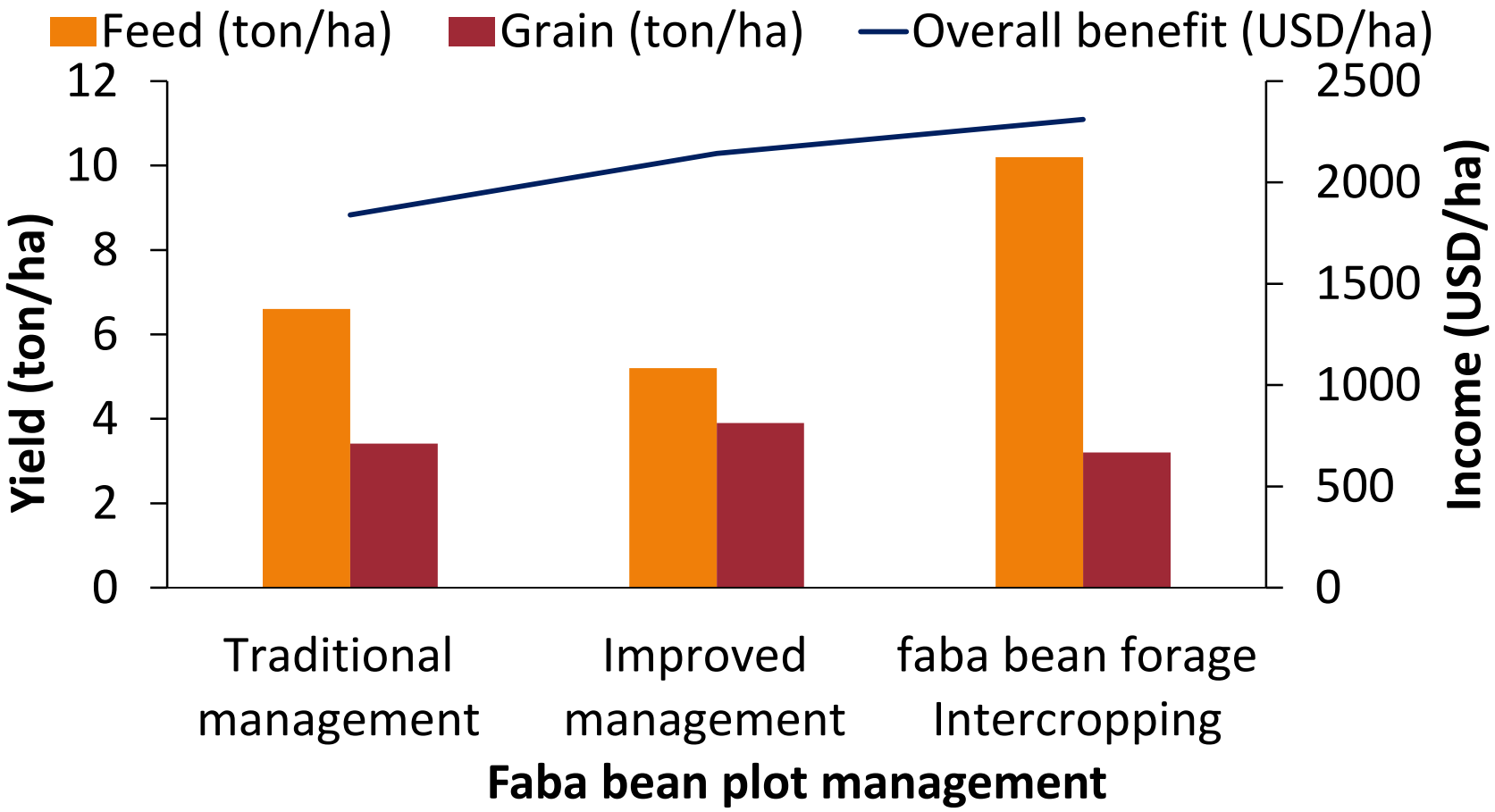


Table 4. Cost benefit analysis of improved vs traditional practices

Variables	Lemo	Basona
Incremental returns		
Incremental Faba bean grain yield (t ha^{-1})	0.43	0.31
Incremental Faba bean residue biomass (t ha^{-1})	0.47	0.57
Total incremental returns (Ethiopian birr)	7,390	5,790
Variable costs		
Labour cost (Ethiopian birr)	1,440	1,440
Net incremental returns (Ethiopian birr)	5,950	4,350
Opportunity costs		
Total weed biomass from traditional practice (t ha^{-1})	1.55	2.15
Total opportunity costs (Ethiopian birr)	3,100	4,300
Value cost ratio (VCR)	**1.92**	**1.01**

Figure 5. Yields and economic gains associated with different management approaches

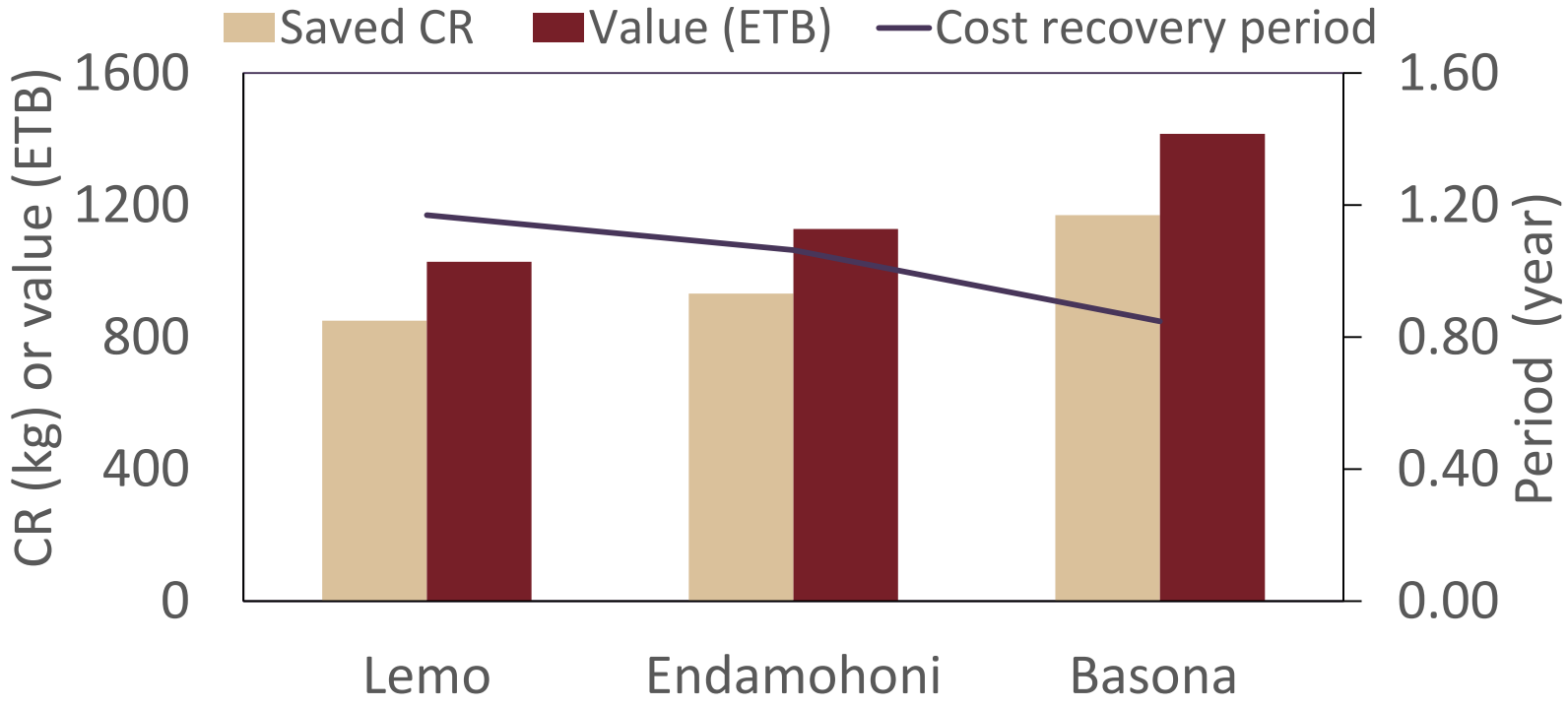


III. Postharvest handling and utilization of feed resources

- Local feed storage and utilization practices incurs wastage of biomass and loss of quality
- Improved feeding trough, storage shed and manual choppers introduced
- Evaluated for their contribution and economic feasibility

- save 30-50% of the crop residue biomass from wastage
- reduce 10-20% of labor demand for feeding

Figure 6. Quantity and value of CR saved due to improved feeding trough per year per household



Key lessons

- Forage interventions - key entry point
- Improved forage cultivation – not an option, but a necessity
- Farmers - willing more than ever to engage in forage cultivation
- Adoption and utilization of improved forages is relatively knowledge intensive: capacity building needs to be a core activity
- Sustainable forage seed system - a priority issue
- Multidisciplinary and multi-sectoral approaches

Ways forward: Africa RISING phase II

- Scaling of tested technologies to more farmers and areas through development partners
- Demonstrating other forage options on the menu
- Creating strong partnership among all stakeholders
- R4D to address emerging issues in the scaling process

Africa RISING CGIAR partners in Ethiopia

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International Water Management Institute

Africa RISING local partners in Ethiopia

- **Academic institutions:**
  - Wachemo, Mekelle, Madawolabu, Debre Berhan and Hawassa universities; Maichew Agricultural College
- **Regional research organizations:**
  - Amhara Regional Agricultrural Research Institute, Southern Agricultural Research Institute, Tigray Agricultural Research Institute, Oromia Agricultural Research Institute
- **Federal research organizations:**
  - Ethiopian Institute for Agricultural Research, Ethiopian Health and Nutrition Research Institute
- **Offices of Agriculture:**
  - Endamekoni (Tigray), Basona Worena (Amhara), Lemo (SNNRP) and Sinana (Oromia)
- **Agricultural Transformation Agency**

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